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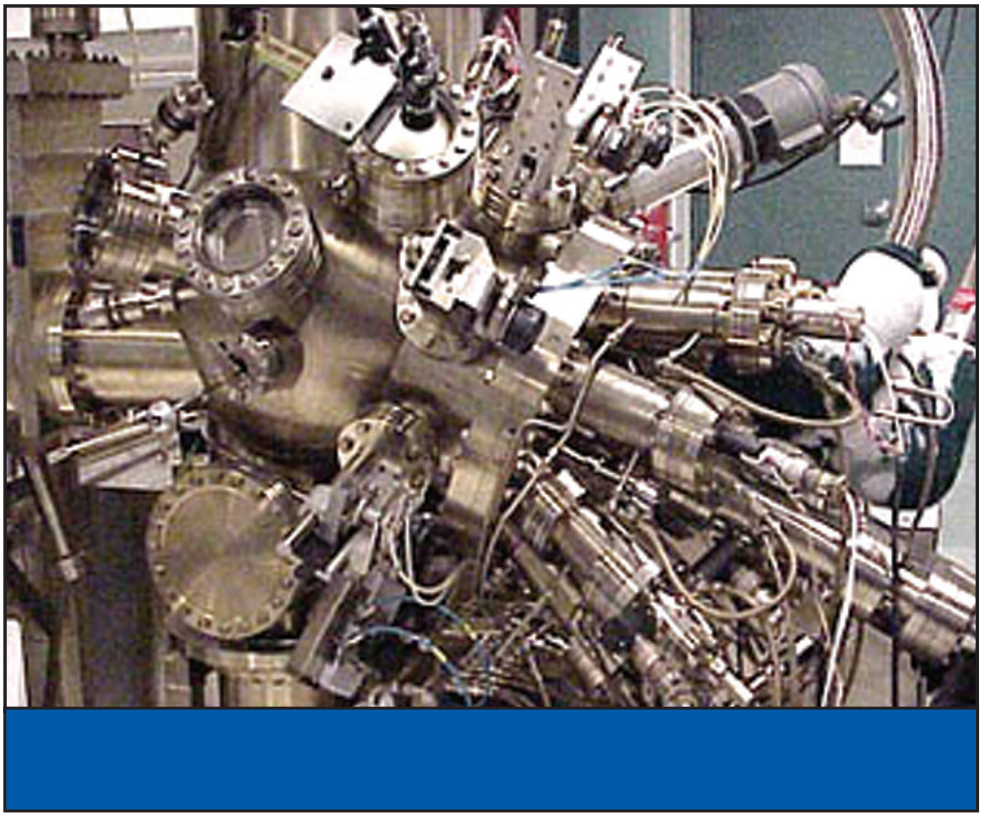
Success Story

MID-IR SEMICONDUCTOR LASERS WITH RECORD POWER AND BRIGHTNESS



The much-improved lateral beam quality of the mid-infrared (IR) semiconductor lasers will enable novel beam-combining schemes that can improve brightness from a small array of semiconductor devices. Consequently, this new generation of lasers results in a substantial reduction of risk in developing compact, efficient sources for numerous applications.

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Accomplishment

The Directed Energy Directorate Mid-IR Semiconductor Research group's in-house research and development produced 4-micron semiconductor lasers. These lasers have many characteristics that make them attractive for applications requiring compact systems.

The directorate demonstrated lasers with record output powers based on advances in type-II quantum well epitaxial growth technology coupled with an improved understanding of the opto-electronic properties of nanometer-scale antimonide thin films. In addition, optimized cavity designs that limit the tendency for filamentation led to a reduction of the slow- and fast-axis divergence, approaching diffraction-limited output.

The increased power, concentrated in a less divergent beam, results in unprecedented brightness for semiconductor lasers operating at this wavelength. This accomplishment strongly benefited from a fruitful interaction with the University of New Mexico's Center For High Technology Materials. The directorate and the University of New Mexico share the epitaxial growth facility.

Background

Scientists can engineer semiconductor lasers to have substantial wavelength agility, with power outputs that can be modulated at high rates, and as semiconductor products that can be mass-manufactured. Since these lasers are extremely small and highly rugged, they are oftentimes ideal for low weight and moderate power applications. Despite enabling the telecom revolution at the 0.8-1.5 micron wavelength range, semiconductor laser development for emission in the mid-IR (3-5 microns) wavelength range is not yet mature.

The directorate pursued contractual development of lasers emitting in the mid-IR wavelength range for numerous applications. The principal achievement of this program was the development of optically pumped 4-micron lasers.

Directed Energy
Emerging Technologies

Additional information

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